Single electron spectrum and elliptic flow in Au+Au collisions at $\sqrt{s_{NN}} = 62.4$ GeV

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Single electron measurement has been proposed to be an effective way to study open heavy flavor production. By measuring charm decayed electron transverse momentum (p_T) spectrum and elliptic flow (v_2) in heavy ion collisions, we can investigate the production mechanism, the in-medium energy loss, the collective property of charm quarks and the possible thermalization of light flavor quarks in the early stage system after collisions [1–3]. Recent single electron measurement from d + Au collisions [4] has provided a good reference of charm production for the coming Au + Au measurements. In this report, we will provide inclusive electron p_T spectrum and v_2 distribution as well as photonic background electron contributions in Au + Au collisions at $\sqrt{s_{NN}} = 62.4$ GeV.

The data set used in this analysis was taken from the STAR detector in RHIC Run V. The total number of minimum biased (0-80%) triggered Au + Au events is 6.8 M within constrained vertex cuts. Electrons were identified by combining the velocity information from Time-Of-Flight (TOF) detector and the ionization energy loss (dE/dx) in the TPC. The details of this analysis were described in [4]. The acceptance and efficiency corrections were done by comparing data and MC simulation data. Photonic background reconstruction was starting with the similar method used in [4]. The upper panel in Fig. 1 shows the inclusive electron spectrum as well as the photonic background contribution in several electron PID selections in Au + Au 62.4 GeV collisions. The excess from open heavy flavor decay is invisible in this p_T region, which is consistent with the expected small charm yields in this collision energy.

Inclusive electron elliptic flow was obtained from standard event plane method. The event plane resolution is $\sim 68\%$ in this analysis, obtained using random subevent method [5]. The inclusive electron v_2 is shown as open symbols in the bottom panel in Fig. 1. As a comparison, the inclusive charged pion v_2 is also shown as yellow band. Photonic background electron v_2 was obtained using event mixing technique to construct the combinatorial background. Due to limited TOF acceptance, all possible electron candidates in the TPC were used in the analysis. Several residual background shapes under photon conversion peak were tried to estimate the systematic errors. The blue solid dots depict the photonic background electron v_2 and the grey bands indicate the systematic errors due to background subtraction in each p_T bin. With current statistics, the photonic electron v_2 and the inclusive electron v_2 are similar.

With high statistics 200 GeV Au + Au data, we expect to see a visible signal excess over the photonic background spectrum. Measurements of non-photonic (photonic background subtracted) electron spectrum and v_2 in Au + Au 200 GeV will help us understand the charm quark in-medium interactions, charm quark collectivity so that we might address the question of early thermalization of light flavor quarks in the system created in the collisions at RHIC.

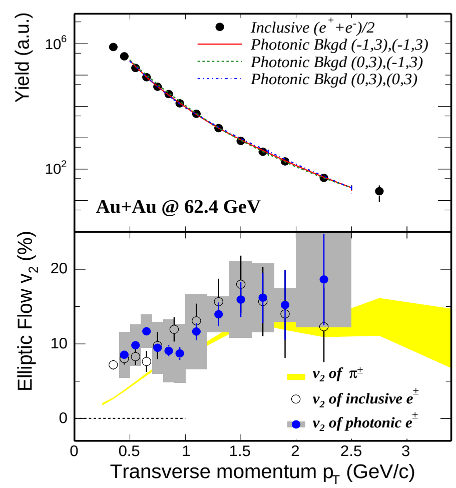

FIG. 1: Upper: Inclusive electron spectrum (black dots) and the photonic background contribution (lines) under several electron selection criteria in Au + Au collisions at $\sqrt{s_{NN}} = 62.4$ GeV. Bottom: Inclusive electron v_2 (open dots) and photonic background electron v_2 (solid dots). The grey bands depict the systematic errors due to background subtraction in each p_T bin. The yellow band depicts the charged pion v_2 in Au + Au collisions at $\sqrt{s_{NN}} = 62.4$ GeV

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